Circular NO. 928

November 1953 • Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE

GRAZING LONGLEAF-SLASH PINE FORESTS

By Weldon O. Shepherd, Byron L. Southwell, and J. W. Stevenson[1]

CONTENTS

INTRODUCTION

Forest range has long furnished a cheap source of forage for the range-livestock industry in the Coastal Plain region of the Southeast. In the past, this industry has been based on a minimum of investment and low returns per animal. The common cattle have shown poor beef qualities but have proved to be very hardy and able to survive with little care. Too often, grazing has been accompanied by promiscuous burning for forage improvement at the expense of other forest values.

A definite trend toward better management of cattle and forest lands has occurred in recent years under the stimulus of increased knowledge and higher prices of livestock and timber. Owners of

[1] Respectively, Range Conservationist (Research), Southeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture; Animal Husbandman, Georgia Coastal Plain Experiment Station; and Animal Husbandman, Bureau of Animal Industry, U. S. Department of Agriculture.

The authors wish to acknowledge contributions of two former associates of the Southeastern Forest Experiment Station: H. H. Biswell participated in the planning and initial execution of the study, and Paul C. Lemon collected much of the field data. Acknowledgment is also made to F. E. Knox and T. S. Boggess, Jr., Bureau of Animal Industry, for making chemical determinations, and W. L. Chapel, Southeastern Forest Experiment Station, for assistance in statistical computations.

forest range are vitally concerned with both of these products. Apparently there are good possibilities for combining grazing and forestry successfully in this region, but determining better procedures for doing so raises many questions involving forage values and problems of managing forage, cattle and timber. Such problems are the concern of a research project begun in 1940.[2] The viewpoint of the research program was that trees should receive first priority in forest land management, and grazing should be considered as a supplementary source of income and as an aid in reducing fire hazard.

This bulletin presents the results of a 5-year experiment concerning cattle production on "wiregrass" range in the longleaf-slash pine forest region. The study provided an excellent opportunity for indicating specific problems underlying efficient production of cattle on Coastal Plain forest ranges. The actual production of calves, weight changes of cows through the seasons and years, and other pertinent observations such as the number and apparent causes of death losses, were carefully recorded. Cattle diet throughout the year and the degree of forage utilization were also observed. Four treatments, representing low-cost feeding practices adapted to nonfarming areas, were applied for supplementing range forage in fall and winter. They gave some indication of the value of such procedures for improving the productivity of breeding herds.

Most of the experimental animals were so-called "native" or "piney-woods" cows such as commonly are found in range herds of the region. A few grade Herefords were also included to provide a limited comparison of the adaptability of these two lines of breeding to forest range conditions (fig. 1).

Results of the study are most applicable to forest ranges in the longleaf-slash pine belt of the lower Coastal Plain, although some aspects may apply also to much of the middle Coastal Plain in this area.

Previous Investigations

A survey of forest grazing practices and conditions in Georgia's Coastal Plain region conducted in 1941[3] brought out the following facts: A large proportion of the beef cattle in the region were grazing range, but the productivity of range herds was rather low in comparison with other cattle regions of the United States. Cattle were small and primarily of "native" breeding although there was a definite trend toward herd improvement and 80 percent of the operators were using purebred or grade beef bulls. Calf crops usually ranged from about 40 to 70 percent.

[2] Investigations conducted cooperatively by the Georgia Coastal Plain Experiment Station; the Forest Service, Bureau of Animal Industry, and Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture; and the Georgia Experiment Station.

[3] Biswell, H. H., Southwell, B. L., Stevenson, J. W., and Shepherd, W. O. forest grazing and beef cattle production in the coastal plain of georgia. Georgia Coastal Plain Expt. Sta. Cir. 8, 25 pp., illus. 1942.

F-431423

FIGURE 1.—A typical scene on the experimental area, showing native and grade Hereford cows on burned range in June.

The farmers reported that breeding cows did rather well from about March 15 to October 15, but lost considerable weight during the remainder of the year when left on range. Best results were being obtained where farmers used field gleanings, harvested feeds or pasture during the winter months. However, in the lower section of the Coastal Plain, comparable to the Alapaha Experimental Range, cultivated land is very limited (5 percent of the acreage of the farms included in the survey) and cattle were depending largely on forest range throughout the year. Here also, calf crops were smallest and death losses highest. Economical procedures for maintaining a satisfactory level of nutrition for the breeding herd—particularly from November until March—with little or no cultivated land, appeared to be the major problem of range cattle production in the lower Coastal Plain.

The different kinds and amounts of native plants making up the cattle diet on Coastal Plain forest ranges have been studied since 1941. Two years' results and observations pertaining to season of use, forage values, and distribution and relative abundance of the principal native forage species in this region are reported in an earlier publication.[4] These early results showed that native forage tends to be deficient in mineral and protein content, especially during late fall and winter. The usefulness of range in this region for winter grazing was found to depend largely on Curtiss dropseed, a grass which is prevalent in the lower Coastal Plain and occurs to a limited extent in the middle Coastal Plain.

Burning the range in winter has been found to increase the protein content and palatability of spring forage, although it

[4] BISWELL, H. H., SHEPHERD, W. O., SOUTHWELL, B. L. AND BOGGESS, T. S., JR. NATIVE FORAGE PLANTS OF CUTOVER FOREST LANDS IN THE COASTAL PLAIN OF GEORGIA. Georgia Coastal Plain Expt. Sta. Bul. 37, 43 pp., illus. 1943.

has little effect on forage quality after early summer.[5] Cattle gains are also higher on burned range in the spring.

EXPERIMENTAL ORGANIZATION

Range

The study was conducted at the Alapaha Experimental Range, Berrien County, Georgia, an area made available by the Georgia Coastal Plain Experiment Station. The site was fairly representative of many areas in the lower and middle sections of the Coastal Plain, particularly in the zone where the two sections merge. The area was almost flat, with swampy drainageways intermixed with imperfectly to poorly drained uplands.

Upland soils were primarily Plummer sand and Lynchburg loamy fine sand. The swamps had a dense stand of slash pine, broadleaved trees (primarily swamp tupelo), cypress, and shrubs and very little forage. A mixture of longleaf and slash pines occupied the uplands. Previous naval stores and logging operations had left only a scattering of mature pine. There was a small amount of pole-size timber and, as a result of 8 years of fire protection, a fair stand of reproduction, mostly of sapling size. Thus, at the start of the study the timber stand was fairly open with a reasonably dense ground cover of "wiregrasses," other herbaceous plants, and shrubs. Established tree reproduction made growth and canopy thickened during the course of the study, but the establishment of any appreciable number of new tree seedlings, particularly slash pine, was prevented by the burning practices applied. An observed decline in forage production was attributed primarily to grazing effects, although the increasing tree canopy was also a minor contributing factor.

Range Treatments and Records

Four range pastures were grazed by four herds from mid-March to about February 1 for 5 years. An additional winter range was used by one herd in February and early March, while the other herds were maintained on harvested feed in dry lot. The herds contained 20 cows each during the first 4 years, but herd size was reduced to 15 cows the fifth year in order to decrease grazing pressure on the ranges.

The four ranges were laid out as nearly alike as possible (fig. 2). Each had about 100 acres of swamp and 200 acres of upland. The herds were rotated among the ranges each year so that each herd grazed every range during the study.

From 1943 through 1945, a different third of the upland was burned each year. Thus, there was roughly 3 acres of fresh burn, 7 acres of other upland, and 5 acres of swamp per cow. During

[5] Halls, L. K., Southwell, B. L., and Knox, F. E. burning and grazing in coastal plain forest; a study of vegetation and cattle responses to burning frequency in longleaf-slash pine forests of georgia. Georgia Coastal Plain Expt. Sta. Bul. 51, 33 pp., illus. 1952.

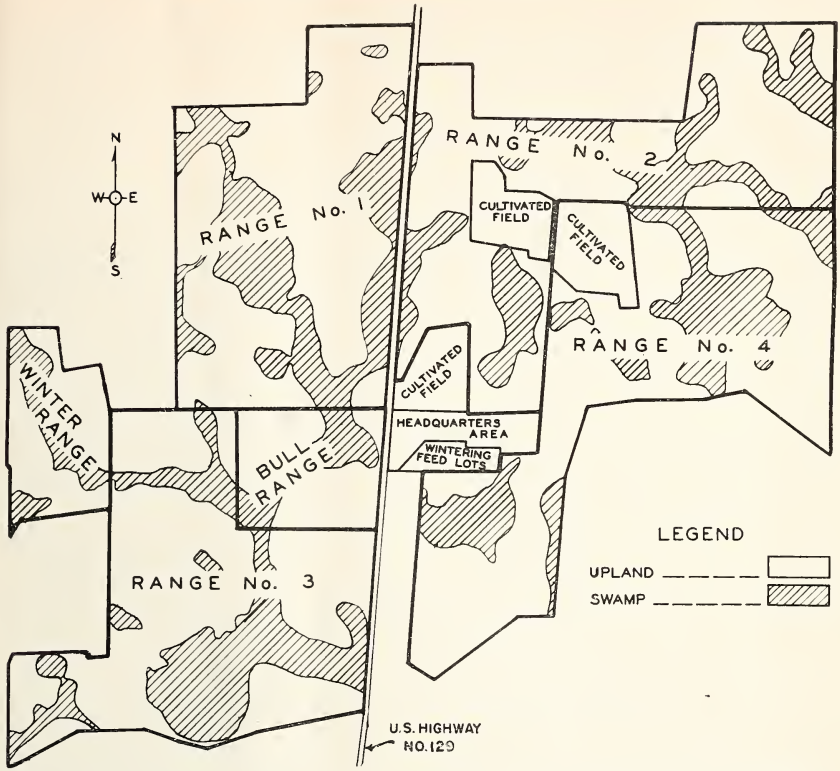


FIGURE 2.—Layout of the four 300-acre ranges grazed from mid-March through January, and the 65-acre winter range used by one herd during February and early March.

the last 2 years, the proportion of burned upland was increased to one-half. This increased the acreage of fresh burn per cow to approximately 5 acres in 1946, and 7 acres in 1947 (since the number of cows per herd was reduced the last year).

The burning was carefully controlled and done according to prescribed conditions and plans during January and February. Little damage resulted to trees more than 8 to 10 feet tall. Smaller longleaf pine reproduction survived burning, but most of the pine seedlings were slash pine and these were killed.

A strong preference of the cattle for freshly burned areas was confirmed by estimates of forage use in relation to time since last burn.

The relative amounts of individual species in the total cattle diet were estimated by direct observations of the grazing animals for 8-hour periods every 2 weeks the first 2 years.

Twelve forage plots, one milacre in size, were randomly distributed at three locations in upland portions of each range. On these, the foliage density (percent ground cover) of understory vegetation was estimated by species before and after the initial burning and grazing season. Density estimates were not con-

tinued because it was thought that the continual removal of foliage by cattle would prevent accurate measurement of vegetational changes by this method.

Cattle

Initially each herd contained two grade Hereford cows and 18 "native" cows of nondescript breeding which were procured from local stockmen. Cows were randomly assigned to the four herds, and the initial assignments were maintained throughout the study. Grade Herefords were used as replacements for native cows that died or were culled, and an effort was made to replace similar numbers in every herd. Therefore, the proportion of Herefords in the herds increased slightly as the study progressed. Most of these replacements were removed, however, when the herd size was reduced to 15 cows the last year. Evaluations of cow performance presented in this report are based primarily on the cows which remained in the study for the full 5 years. This included 48 natives and 6 grade Herefords.

Purebred Polled Hereford bulls were used with all herds (fig. 3). The breeding season was restricted to about 2 months, beginning May 1. Consequently, most of the calves were born during the dry-lot feeding period, February 1 to March 20. Each bull was placed with a different herd each year. And if possible, a bull was kept 4 years so that he would be used with every herd.

Cattle were weighed seven times per year at approximately the following dates: October 15, December 9, January 31, March 20, May 9, July 5, and August 30. Weights were obtained on three successive days at the October, January, and March dates, which corresponded to changes in management. At other times

F-429221

FIGURE 3.—Representative native cows, first-cross calves, and herd bull on burned range in May.

the cattle were weighed once. Birth weights of calves were obtained in addition to the periodic weights. The calves were weaned about October 15.

Pertinent portions of the cattle data were analyzed statistically to aid in the interpretation of the results.

Fall and Winter Feeding Practices

From October 15 through January, three herds were fed supplemental protein meal; two herds received 2 pounds per head per day and the third, 1 pound. To save labor, the supplement was fed three times a week rather than daily during this period. The fourth herd received no supplement except in two years when a ration of 1 to 1.5 pounds per day was required after mid-December to prevent excessive starvation losses.

From February 1 to March 15, three herds were maintained in dry lot on a daily ration of 20-25 pounds of chopped sugarcane and 2 pounds of protein meal. The other herd, which had received the 2-pound rate of range supplement, was moved to a separate 65-acre unburned range and fed 2 pounds of protein meal per head daily.

A mineral mixture was available to the cattle at all times. Special measures taken to encourage increased mineral consumption are described in a later section concerning forage quality.

EFFECT OF BURNING ON RANGE USE

That cattle are attracted to burned areas in the wiregrass region is a commonly observed fact. To get some measure of the preference for winter burned range at different seasons, cattle distribution in the experimental ranges was noted and recorded biweekly, and at other opportune times, during the first 2 years of the study. Also, the relative degree of forage utilization in relation to the burning cycle was recorded biweekly for each range. The observations for the second year—when the cattle had a choice between fresh burn, 1-year rough, and old rough —are summarized in tables 1 and 2. The first year, when only fresh burn and old rough were available, the use of fresh burn was similar to that shown in the tables (the remainder being old rough) until October. Thereafter, grazing time the first year was divided about equally between the burn and the old rough, which included swamps.

The strong preference for burned range essentially prevented use of unburned areas during spring and summer. During this period the cattle spent most of their grazing time on the fresh burns even though these areas were closely utilized. The limited grazing time spent off the fresh burns during spring and summer was mostly on 1-year rough (areas burned the preceding year) rather than older rough. This was perhaps because the 1-year rough had less accumulated dead herbage and pine needles. Much of the time spent in the rough during summer was along old firelanes or other spots containing carpetgrass.

TABLE 1.—*Approximate percentage of grazing time spent on different-aged rough, by months* [1]

Month	Fresh burn	1-year rough	Old rough [2]
	Percent	*Percent*	*Percent*
March	89	11	0
April	82	18	0
May	93	7	0
June	94	6	0
July	88	12	0
August	85	8	7
September	71	15	14
October	43	7	50
November	36	39	25
December	30	25	45

[1] Based on the average distribution of cattle during two to four observational periods per month, all herds.
[2] Uplands unburned for 9 years, and swamps.

TABLE 2.—*Relative degree of forage utilization in relation to age of rough* [1]

Month	Fresh burn	1-year rough	Old rough
March	Light to moderate.	Light	Light.
April	Moderate	do	Do.
May	Moderate to close.	do	Do.
June	Close	do	Do.
July	do	do	Do.
August	do	do	Do.
September	do	do	Do.
October	Close to moderate.	do	Do.
November	Moderate to close.	do	Do.
December	do	do	Do.
January	do	Light to moderate.	Light to moderate.

[1] From biweekly estimates of forage utilization on each of the four ranges.

After September, grazing time as a whole was about equally distributed between the current burns, the previous year's burns, and older rough (including swamps). By this time the forage remaining on the current burns had lost its advantage in palatability, and the cattle were more willing to go into unburned areas where the forage was more abundant. Considerable use was made of the limited swamp forage late in the season, particularly during dry periods.

Because of the strong tendency of the cattle to concentrate on the fresh burns in spring and early summer, the ranges in the present study were probably stocked too heavily for best cattle performance. When only 3 acres of fresh burn per head were provided, utilization of nearly all available forage on the burns permitted little selectivity among species in regard to palatability and, perhaps, forage quality. Also, the heavy utilization was apparently weakening the forage stand. The burned acreage was therefore increased to 5 acres per cow in 1946 by altering the burning schedule, and to 7 acres per cow the following year by reducing the number of cows in each herd. After each of these adjustments, cattle gains during the spring increased over the previous year. The average relative gains per cow for all herds during the period March 20 to May 9 were as follows (after adjusting for average effect of calving on gains; adjusted to the average calf crop).

	Gain per cow (pounds)
1943	41
1944	26
1945	15
1946	41
1947	65

Calf gains showed a similar, though less pronounced, trend. Average weaning weights, significantly lower in 1945 than in other years, were as follows:

	Calf weight (pounds)
1943	280
1944	275
1945	252
1946	280
1947	283

Although the study was not designed to investigate grazing capacity of forest range, the results cited above, and observations of grazing habits mentioned previously, indicate that grazing capacity during the spring and summer should be based entirely on the acreage of freshly burned range available and not on the total range area. It is evident from the record that 3 acres of fresh burn per cow from 1943 to 1945 were not enough to satisfactorily support the cattle during the spring and summer. It is doubtful that 5 acres of burn provided per cow in 1946 were adequate, because by that time all of the upland range had been weakened by overgrazing following the first cycle of burning. At the end of the 1946 season the fresh burns were classified as closely utilized and cattle gains were similar to those of the first year. In 1947, when 7 acres of fresh burn were provided per cow and utilization was only moderately close, the cattle made the best gains. Five or six acres of vigorous range in the beginning would probably have been equivalent to 7 acres of deteriorated range at the end of the study. Apparently, at least 6 acres of prescribed-burned range should be available for each cow for the spring and summer grazing period.

RANGE PLANTS

The vegetation in the experimental area was quite typical of the middle and lower sections of the Coastal Plain region in Georgia. The following tabulation shows the relative abundance of the principal species, exclusive of trees, at the start of the experiment. The data apply only to the upland parts of the ranges which could be prescribed-burned. They do not include wet drainageways and swamps having dense tree and brush cover but very little grazing value, which occupied one-third of the area.

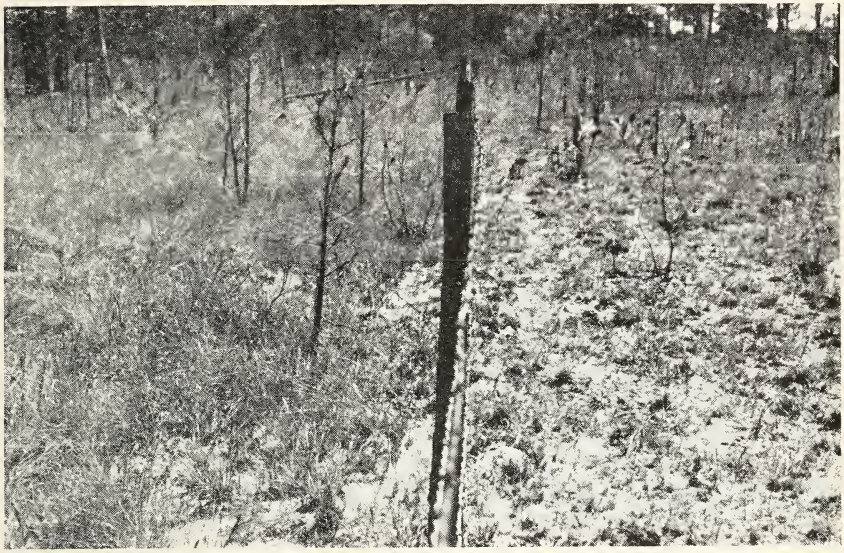
	Proportion of the total foliage (percent)
Grasses and grasslike plants: [1]	
Pineland threeawn	20.3
Curtiss dropseed	19.7
Florida dropseed	6.3
Bluestems	6.1
Carpetgrass	2.7
Toothachegrass	2.3
Panic grasses	1.6
Lopside Indiangrass	1.1
Miscellaneous grasses and grasslike plants	1.9
All grasses and grasslike plants	62.0
Forbs (broadleaved herbs):	
Trilisa	1.4
Pipewort	.7
Goldaster	.4
Aster	.4
Miscellaneous forbs	4.7
All forbs	7.6
Shrubs:	
Gallberry	20.5
Sawpalmetto	5.9
Lyonia	1.4
Blackberry	1.1
Miscellaneous shrubs	1.5
All shrubs	30.4
Total understory [2]	100.0

[1] Botanical names are given at the end of this publication.

[2] An average of 48 percent of the ground surface was estimated to be completely covered by the combined foliage of the herbaceous and shrubby plants in the forest understory.

Two of the so-called "wiregrasses," pineland threeawn and Curtiss dropseed, were the most abundant forage species, followed by Florida dropseed and bluestem grasses. Of the latter, yellowsedge bluestem ("broomsedge") and creeping bluestem were most prominent, although small amounts of bushy bluestem, slender bluestem and others occurred also. Broadleaved herbs (forbs) were relatively unimportant. Together, they made up about 8 percent of the vegetation. About one-third of the understory vegetation was shrubs, gallberry being by far the most prevalent species.

In general, the forage stand was reasonably dense since the tree canopy was fairly open. Initially there was enough living foliage of grasses and forbs in the upland areas to completely cover one-third of the ground surface. A considerably greater amount of accumulated dry herbage was intermixed with the forage before it was burned off. After prescribed burning in winter, the native grasses produced abundant regrowth during the spring and summer, and total forage production on burned areas apparently equaled or exceeded the amount produced on unburned areas. However, the heavy grazing of the fresh burns decreased the density and productivity of the forage stand (fig. 4).



F-429211

FIGURE 4.—An April view of ungrazed and closely grazed wiregrass range burned in early February.

Although utilization was light during the years between burnings, some species failed to recover fully from the close grazing following burnings. This was particularly true of the long-leaved bunchgrasses, pineland threeawn, Curtiss dropseed, and Florida dropseed. In response to the reduced competition from the bunchgrasses, other grasses having a low and spreading growth habit, and therefore more tolerant of heavy grazing, tended to increase somewhat. The latter group included carpetgrass and panicums (primarily *Panicum ciliatum, P. albomarginatum,* and *P. aciculare*). These trends are illustrated in table 3 for the first year of burning and grazing. Similar data were not taken the next year, and thereafter no unburned comparisons were available. A gradual thickening of the tree canopy may have also contributed to an observed decrease in grass density in the late years of the study.

TABLE 3.—*Percent of ground surface covered by current herbage on permanent plots before treatment (1942) and after the first burning and grazing season (1943)*[1]

Treatment and year of estimate	Species					
	Pineland threeawn	Curtiss dropseed	Florida dropseed	Other grasses	Forbs	Total
Burned, grazed:	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1942	9	12	7	7	4	39
1943	3	4	1	8	5	21
Burned, ungrazed:						
1942	8	8	4	10	4	34
1943	8	10	4	8	4	34
Unburned, grazed:						
1942	13	10	2	7	4	36
1943	14	9	2	7	3	35
Unburned, ungrazed:						
1942	8	9	2	7	4	30
1943	9	9	2	8	3	31

[1] Average of ocular estimates in November of each year on 12 plots (6.6 feet square) which were burned in February 1943, and 24 similar plots in unburned areas. Dead herbage produced in previous years was not included in the estimates.

From the viewpoint of fire control, the heavy utilization of herbage on fresh burns was of distinct value. Fuel accumulation during the first growing season following fire was so slight that the same areas would not burn readily the next winter. Consequently, such areas often did not require the protection of plowed firebreaks when adjacent range was being burned. An appreciable reduction in fuel accumulation, due to grazing, was still apparent during the second and third years after burning.

CATTLE DIET

The kinds and amounts of range plants making up the diet of the herds at all seasons were studied for 2 years (March 1943 to March 1945). From close observation of the grazing animals, the various species being eaten and the proportion that each was contributing to the total diet was estimated every 2 weeks. The average results of these observations are given in table 4 and figure 5.

Roughly three-fourths of the cattle diet consisted of pineland threeawn, Curtiss dropseed, bluestem grasses, and carpetgrass.

Pineland threeawn contributed about half of the total forage during the first month in the spring. Utilization of this species, however, was almost entirely restricted to the fresh burns. It soon becomes tough and unpalatable. On ranges lightly stocked with cattle this species is seldom grazed after June.

Curtiss dropseed remains green and relatively palatable in winter, when the leaves of many other grasses have dried up, and at that season it furnished the greater part of the cows'

TABLE 4.—*Estimated species composition of cattle diet during four periods of the year* [1]

Species	Late March–May	June–September	October–January	February–early March [2]
	Percent	*Percent*	*Percent*	*Percent*
Pineland threeawn	39.0	10.1	3.4	5.7
Curtiss dropseed	23.8	12.6	38.0	68.3
Carpetgrass	.7	13.0	9.3	----
Creeping bluestem	7.7	18.0	9.2	.3
Yellowsedge bluestem	1.2	16.6	10.6	.7
Bushy bluestem	.2	.7	.7	----
Slender bluestem	----	.8	.7	----
Florida dropseed	7.4	6.6	6.8	2.3
Toothachegrass	5.5	5.5	4.5	2.7
Panic grasses	5.0	1.0	.8	----
Sedges and rushes	.3	.2	.3	----
Forbs	2.1	3.8	2.6	2.0
Browse	3.4	4.5	6.7	14.0
Miscellaneous	3.7	6.6	6.4	4.0
Total	100.0	100.0	100.0	100.0

[1] From biweekly observations over a 2-year period.
[2] For the one herd which was on separate unburned range during this period.

diet. This species also produces early spring forage and it was grazed throughout the year. However, mid-summer utilization of Curtiss dropseed would undoubtedly have been lighter if such species as carpetgrass and slender bluestem had ben more plentiful.

Bluestem grasses were a major source of forage from June through November but they were grazed very little at other seasons. Individual bluestem species were taken approximately in proportion to their relative abundance, creeping bluestem and yellowsedge bluestem contributing at least nine-tenths of the bluestem forage.

Carpetgrass was highly palatable from June to December on the experimental ranges, but because it was not plentiful it contributed only 10 to 20 percent of the forage consumed during the summer months.

Florida dropseed and toothachegrass were grazed throughout the year and together made up about 12 percent of the total diet. They were grazed most heavily on burns early in the season. Later they were grazed lightly in the rough, particularly bordering the swamps where they were most plentiful.

Other grasses were of little importance to the cattle diet. Panicums (5 or 6 species) contributed about 5 percent in the spring, and coastal lovegrass about 3 percent during the summer and autumn. Sedges and other grasslike species made up no more than 1 percent at any season.

Pipewort, trilisa, tickclover, goldaster, and aster were the main forbs eaten. Together they made up only 2 or 3 percent of the total feed.

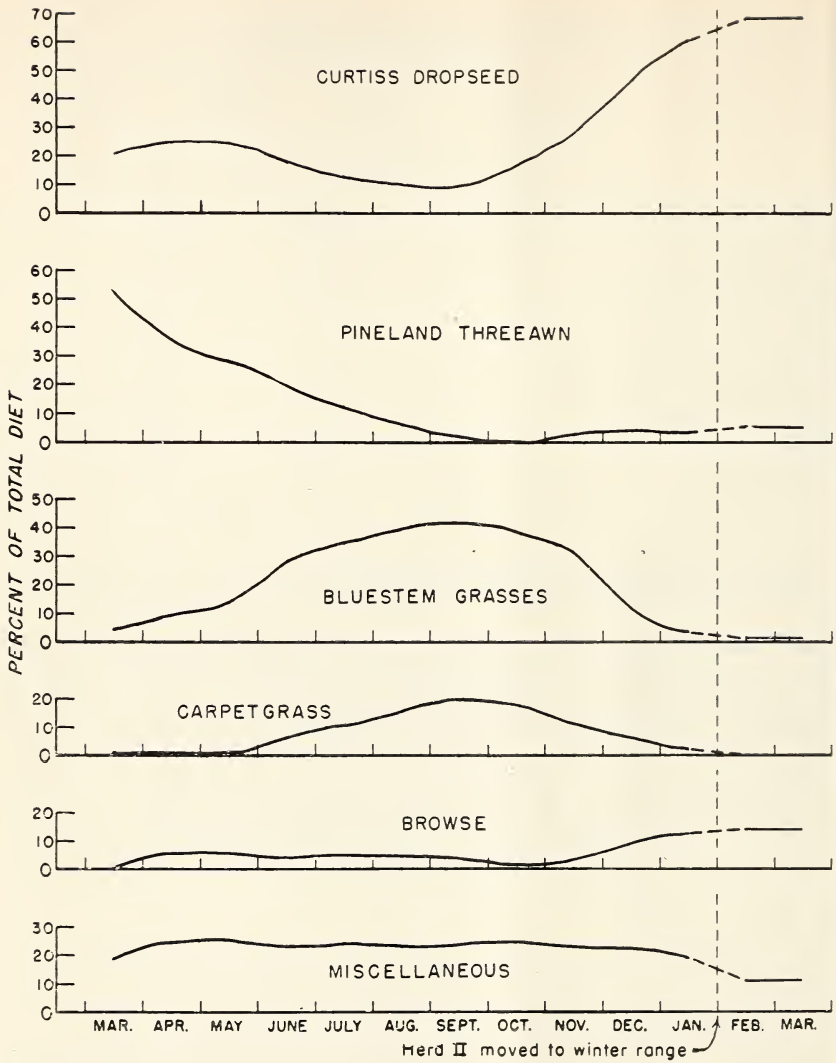


FIGURE 5.—Proportion of principal plants making up the total diet of the cattle. Miscellaneous plants include Florida dropseed, toothachegrass, panic grasses, and other grasses, sedges, rushes, and forbs.

Shrubs and hardwood sprouts of various kinds were browsed rather consistently, and in winter, when other green forage was limited, browse constituted an appreciable proportion of the diet. The species contributing most were myrtle dahoon, swamp cyrilla, sweetbay magnolia (*Magnolia virginiana*), saw-palmetto, and black tupelo (*Nyssa sylvatica*).

FORAGE QUALITY

At the same time that this experiment was going on, cattle diet was also being investigated on other adjacent range units. In these, the quality of the diet was studied as well as the kinds of plants which were being grazed. Forage samples representing the diet were obtained by following the cows and attempting, by hand, to duplicate their grazing. Samples collected in this manner each month (except November and December) for 2 years were analyzed chemically to get an idea of the nutritive quality of the native forage at different seasons of the year. Since these samples contained approximately the same kinds of plants from comparable range land, and in proportions similar to those shown in figure 5, they reflect very closely the diet of the cattle in this experiment.

The protein, calcium, and phosphorus content of the forage samples are given in table 5. These are the constituents most clearly deficient in the native forage.

The values in table 5 indicate a considerably lower quality diet than that of a previous study on other wiregrass ranges in the middle and lower Coastal Plain.[6] In the earlier study, crude protein averaged above 9 percent from March through September and was seriously deficient only in winter. Similarly, phosphorus averaged about 0.12 percent and calcium about 0.20 percent during the summer months. Such discrepancies might be due in part, at least, to differences in soils between the range areas studied. Another possible explanation is that the cattle in the former study had more range available to them and they could be more selective in their grazing habits. As a rule, cattle seem to take the most nutritious forage first whenever they have a choice. Therefore, the amount of range available may affect cattle performance through its influence on the quality of the diet as well as the total quantity of forage.

The amounts of nutrients required by cattle vary, of course, according to size, age, stage of pregnancy or lactation, and other conditions. For efficient productivity, the proportion of protein in the diet must be nearly twice as high for young growing animals and nursing cows as for nonpregnant dry cows. A minimum of 4.5 to 5 percent of digestible protein in the diet is recommended for breeding cows.[7] This would require a minimum crude protein content of at least 9 percent, assuming that the crude protein were 50 percent digestible. Although the digestibility of the kind of native forage grazed in this study has not been determined, probably not more than 50 percent of the crude protein was digestible except perhaps in early spring. On this basis, the data in table 5 indicate that the native forage did not contain enough protein for good performance of a breeding

[6] See footnote 4.

[7] GUILBERT, H. R., GERLAUGH, PAUL, AND MADSEN, L. L. RECOMMENDED NUTRIENT ALLOWANCES FOR DOMESTIC ANIMALS. RECOMMENDED NUTRIENT ALLOWANCE FOR BEEF CATTLE. Report No. 4 of the Committee on Animal Nutrition. National Research Council, Washington, D. C., 32 pp. 1945.

TABLE 5.—*Protein, calcium, and phosphorus content of forage samples representative of cattle diet by months* [1] [2]

[In percent of oven-dry weight]

Month	Crude protein	Calcium	Phosphorus
March	9.05	0.12	0.12
April	7.77	.14	.10
May	6.65	.13	.09
June	6.01	.12	.08
July	5.95	.17	.08
August	5.38	.17	.08
September	4.83	.16	.08
October	4.62	.16	.06
January–February (unburned winter range)	3.66	.30	.05

[1] Approximate minimum requirements for acceptable performance of growing animals or cows nursing calves: Crude protein 9 percent, calcium 0.24 percent, phosphorus 0.18 percent. Approximate requirements of nonpregnant dry cows: Crude protein 7 percent, calcium 0.15 percent, phosphorus 0.10 percent.

[2] Chemical analysis by F. E. Knox, Bureau of Animal Industry, U. S. Department of Agriculture.

herd, especially for cows with suckling calves. Apparently their diet was not adequate to provide the level of nutrition required for a sustained high calving percentage or to sustain the amount of milk production necessary for rapid calf gains.

The ration of breeding cows should contain a minimum of 0.20 to 0.24 percent calcium and 0.18 percent phosphorus.[8] The native forage was deficient in both of these minerals (table 5). Although a mineral mixture was available to the cattle at all times, considerable difficulty was encountered in getting some cows to eat enough mineral supplement to satisfy their needs for phosphorus.

At the beginning of the study, a mixture of equal parts salt, ground limestone, and bonemeal was self-fed at one location in each range. Analysis of periodic blood samples indicated adequate blood calcium, but reduced levels of blood phosphorus in late summer and early fall. Among cows nursing calves, blood phosphorus during this period tended to fall below the level generally considered to be critical (4.00 mg. per 100 cc. of blood serum).

Three corrective measures were taken to increase phosphorus consumption. First, the mineral mixture was changed to 1 part salt and 2 parts bonemeal. Second, an additional mixture of bonemeal and cottonseed meal (equal parts by weight) was fed seasonlong at the rate of 25 pounds per week for 20 cows. This supplied only a minor amount of phosphorus but was designed primarily to attract the cows to the mineral boxes. Third, additional mineral boxes were placed in each range so that the supplement would be more accessible to the animals. These practices resulted in greater and more uniform consumption of minerals and higher levels of blood phosphorus.

[8] See footnote 7.

In spite of the corrective measures, however, a few cases of low blood phosphorus were found. These were among cows which were observed not to eat the mixture consistently, or cows which had produced calves in two consecutive years. Also, the herds receiving the least amount of protein supplement consumed the least mineral mixture and tended to have the lowest level of blood phosphorus. These results indicate that cows may not eat enough mineral supplement, when fed free-choice, to completely overcome the mineral deficiency of wiregrass range forage. Special practices to induce adequate mineral consumption, such as mixing with protein meal or other supplemental feed, may be desirable.

CATTLE PRODUCTION

The productivity of the range herds, in terms of calf crops and total weight of calves weaned, was rather low in comparison with the average for all range areas of the United States but fairly good for lower Coastal Plain ranges of this region. For the 54 cows remaining in the study the full 5 years, the annual calf crop (weaned calves) averaged 58 percent. The percentage calf crops obtained during each of the 5 years, 1943 to 1947 were 96, 19, 74, 35, and 64 percent, respectively. During the initial breeding season on the range all cows were open and dry and in reasonably good condition. The resulting high calf crop of 1943 (96 percent) profoundly affected the results through the remaining 4 years, a period when the study aimed primarily to determine the influence of differing fall and winter feeding practices.

Cows suckling calves during the breeding season usually failed to calve the following year. With most of the cows suckling calves in 1943, the first year after the fall and winter feeding treatments, few were in sufficiently good condition to breed in the summer of 1943 and the calf crop of 1944 was only 19 percent. There were only 20 instances, involving 18 cows, when cows weaned calves 2 years in succession. This amounts to a 16-percent calf crop from wet cows, since cows were suckling calves in 121 instances during the breeding seasons of 1943-46.

On the other hand, dry cows usually bred successfully. Thus, in 149 cases where cows were dry during the breeding season, 136 calves were produced the following year. This was a calf crop of 91 percent.

The failure of a high proportion of cows suckling calves to breed, and the fact that dry cows bred and had calves the next year, is shown in the following tabulation of calving sequences of the cows which were in the study all 5 years:

Calves per cow	*Calving sequence*	*Number of cows*
4	Three years in succession	1
4	Two years in succession, twice	1
3	Two years in succession, once	16
3	Every alternate year	28
2	Alternate, but missing 2 successive years	7
2	First and last years only	1
	Total	54

An explanation for the failure of most cows to calve in successive years is suggested by figure 6. Only a small proportion of the weight losses incurred by bred cows during the winter or during calving was regained by breeding time, regardless of the supplemental feeding practiced. In addition, cows suckling calves were generally losing, or barely holding their weight, during the breeding season.

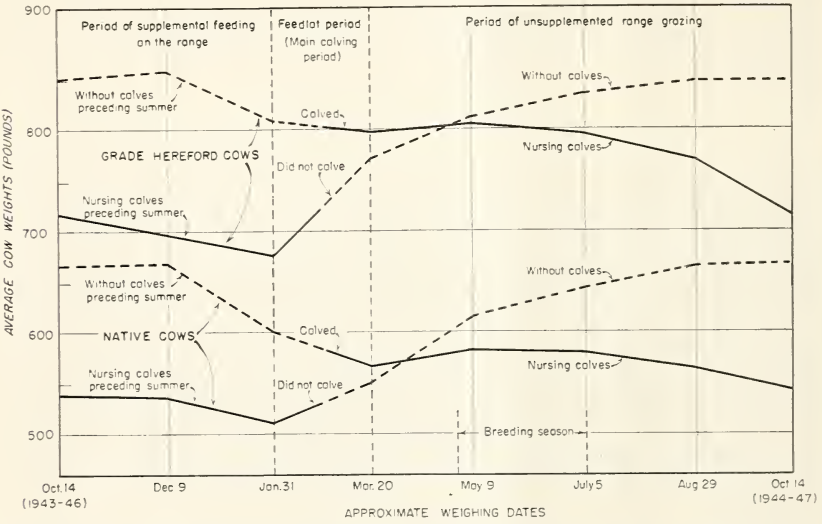


FIGURE 6.—Seasonal trends in weights of cows with calves and those without calves (average of all herds for 4 years).

Cows which had calves the preceding summer but which did not breed that year were in very poor condition at the start of the feed-lot period. They gained during that period and continued to gain through the spring and the breeding period. Since a high proportion of these dry cows then bred successfully they apparently were in reasonably good breeding condition.

In the 20 instances when cows weaned calves 2 years in succession, the cows were lighter by an average of 24 pounds on the second weaning date than on the preceding one (table 6). Also, the second calves were smaller at weaning time by an average of 26 pounds than those of the preceding year. Thus, the general condition of the cows became progressively poorer at successive calvings. Only 1 cow was able to produce as many as 3 calves in succession.

These results, together with the chemical data presented in the previous section, indicate nutritional deficiencies in wiregrass forage for cows with suckling calves, but the forage appears to meet the minimum requirements for breeding of dry cows. Apparently the quality of the native forage is not high enough to satisfy the requirements for lactation and for reproduction at the same time.

TABLE 6.—*Average weights of cows and calves at weaning in the 20 cases when cows weaned calves in successive years*

Year	Cases	Cows		Calves	
		First year	Second year	First year	Second year
	Number	*Pounds*	*Pounds*	*Pounds*	*Pounds*
1943–44	7	614	624	292	261
1944–45	1	630	544	360	282
1945–46	8	547	511	277	273
1946–47	4	690	643	302	254
Average (weighted)		603	579	291	265

Calves from the entire herd of 54 cows at weaning time, when they were about 7½ months old, averaged 272 pounds (fig. 7). This represents an annual production of 157 pounds of calf per cow over the 5-year period. This low production per cow is, however, greater than that usually produced in the lower Coastal Plain.[9]

Death Losses

Calf losses were reasonably light. Among the calves from the 54 cows in the study for the full 5 years, there were only 6 known calf losses, including 2 abortions. This represents a loss of less than 4 percent of the known conceptions in this group (156 calves were weaned). All cows in the study, including those which were replaced and their replacements, weaned a total of 209 calves. The total recorded calf losses from this entire group of cows were classified as follows.

	Number
Aborted	4
Born dead or too weak to suckle	6
Died of starvation or other causes	5
Total	15

Five of the calves born dead or too weak to suckle were in the herd receiving the least supplemental feed. The other losses did not appear to be correlated with the fall and winter treatments.

Death losses among cows averaged 4.2 percent per year. For all cows and all years (380 cow-years of record), the death losses and diagnosed causes were as follows.

	Number
Starvation	10
Lightning	1
Cancerous growth	1
Bruise or snakebite	1
Unexplained	3
Total	16

[9] See footnote 3.

F-434010

FIGURE 7.—Seven- to eight-months-old calves from the experimental herds at weaning in October.

Death losses from starvation were affected by the supplemental feeding treatments and will be referred to again in a later section. Some starvation losses, however, were not directly related to the level of nutrition of the herd as a whole, but rather to the temperament of individual animals.

When a limited amount of concentrated feed was supplied to groups of cattle on range, there was a tendency for shy, small, or weak cows to be crowded away from the troughs and not get their share of the feed. This situation had a cumulative effect—each failure to obtain feed further weakened the animals and made them less aggressive. Four starvation losses of this nature, three during the first 2 years, occurred in the herds receiving the most supplemental feed. Providing extra feed-trough space after the second year helped alleviate this situation but did not prevent the loss of one additional shy cow. In a practical operation, such animals should be culled from the herd.

CATTLE RESPONSE TO FALL AND WINTER FEEDING

In sections of the region where farmland is limited, many cattle were found to subsist almostly entirely on forest range yearlong.[10] Even though herd productivity was low, costs were also low and cattle owners considered the practice economical. Under these conditions the cattle ordinarily lost considerable weight after mid-October, and starvation losses were common in February and early March when limited new growth on fresh burns "baited" the cattle off the unburned range where forage was more abundant but less palatable. Some cattle owners had tried supplementing the range forage with the low-quality hay available in the area. They reported, however, that this

[10] See footnote 3.

tended to keep the cows from utilizing the range forage. To be of any benefit, a full maintenance ration of hay was required, which materially increased costs.

In this study it was found that starvation losses could be avoided and the productivity of range herds increased at little cost by supplementing the range diet with concentrated protein feed during the fall and early winter, and by withholding the cattle from freshly burned range until forage had developed adequately in the spring. The protein supplement did not interfere with range utilization. On the contrary, it improved the cattle's appetite, and they consumed more mineral supplement (available free choice) and apparently more forage.

Four procedures were compared on individual herds. They involved different amounts of range supplement, and supplemented range versus dry-lot feeding during the period between burning and range readiness. The amounts of supplement fed on the range from October 15 to January 31, and the method of maintenance from February 1 to March 15, were as follows.

	Supplement Oct. 15-Jan. 31 (pounds/head/day)	*Maintenance, Feb. 1-Mar. 15*
Herd I	2	Dry lot.
Herd II	2	Range (supplemented).
Herd III	1	Dry lot.
Herd IV	0–¾	Dry lot.

In dry lot the cattle were fed 2 pounds of cottonseed meal and 20 to 25 younds of chopped sugarcane per head daily during the last 4 years. Comparable results were obtained when 10 to 12 pounds of peanut hay replaced the sugarcane one year (1943), but costs were higher. The average cost of producing, harvesting, chopping, and feeding a ton of sugarcane was less than $5. At the same time, the market price of peanut hay was approximately $16. Since 20 to 35 tons of feed per acre are readily obtained, sugarcane is a promising roughage for winter feeding of cattle in areas of limited agricultural land in this region (fig. 8). Procedures for its culture and use have been published.[11]

Herd II was maintained on unburned range, supplemented with 2 pounds of protein meal per head daily, during the time the other herds were in dry lot. A 65-acre range reserved for this use was adequate for 20 cows for a 7-week period, and replaced about 10 tons of sugarcane annually.

Major comparisons among the four herds for the 4-year period following the initial high calf crop of 1943 are presented in table 7. Except for starvation losses and seasonal weight changes of cows, differences resulting from the different feeding practices were not great. Pertinent phases of the results will be considered separately in order to bring out limitations of native range and possibilities for improving the productivity of range herds.

[11] STEVENSON, J. W., AND SOUTHWELL, B. L. SUGARCANE, AN ECONOMICAL WINTER ROUGHAGE FOR THE LOWER COASTAL PLAIN OF GEORGIA. Georgia Coastal Plain Expt. Sta. Cir. 13, 11 pp. 1948.

F-434055

FIGURE 8.—Sugarcane shocked for winter feed. The cane is run through a silage cutter and fed in troughs. Yields of 20 to 35 tons per acre (measured when fed) were produced.

Starvation Losses

Herd IV was intended to be a check group receiving no supplemental feed while on range. However, in 1943 and 1945—years when a high percentage of the cows had produced calves—supplemental feeding was necessary for the last 6 weeks of the October–January period to prevent excessive death loss from starvation in this herd. Beginning about December 15, approximately 1.5 pounds per head daily were required in 1943 and 1 pound daily in 1945—equivalent to 0.75 pound and 0.5 pound, respectively, over the entire period. Without the supplement, at least 80 percent of the cows in this herd would have died in 1943 (or January 1944), and 50 to 60 percent in 1945, according to judgment of the project personnel.

Over the 5-year period, a total of 7 starvation losses occurred out of the 20 to 15 cows kept in herd IV (95 cow-years of record). This amounts to a 7 percent loss per year. An additional two or three cows in this herd were saved by special individual care.

Starvation losses among grade Herefords were proportionately greater than among native cows. In herd IV, the average annual loss amounted to 18 percent of the Herefords and 4 percent of the natives.

Among the herds receiving protein supplement regularly on the range after mid-October, starvation losses were inconsequential. Only three such losses occurred in the three supplemented herds over the 5 years. All of these were timid native cows, one from herd I and two from herd II.

TABLE 7.—*Average performance per cow by herd and kind of cattle during the 4-year period, October 1943 to October 1947* [1]

Item	Herds				Kind of cattle	
	I	II	III	IV	Native	Grade
Initial weight October 1942 [2]—pounds	668	652	673	643	633	871
Seasonal changes in weight:						
Oct. 14 to Jan. 31 (range)—do	−26	−5	−51	−88	−44	−42
Jan. 31 to Mar. 20 (feedlot) [3]—do	18	−52	28	39	7	41
Total for feeding period—do	−8	−57	−23	−49	−37	−1
Mar. 20 to July 5—do	28	81	42	69	56	31
July 5 to Oct. 14—do	−9	−9	−6	−11	−5	−33
Total for unsupplemented range—do	19	72	36	58	51	−2
Average weight Oct. 14, 1944–47—do	663	628	620	595	608	782
Annual calf crop—percent	48	52	48	42	47	50
Birth weight of calves—pounds	55	55	49	47	51	59
Weaned weight of calves—do	283	291	273	245	276	260
Daily gain per calf [4]—do	1.01	1.02	0.95	0.84	0.97	0.87
Annual feed consumption:						
High protein meal (October to March)—pounds	320	321	211	135		
Chopped sugarcane (February to March)—do	1,130	0	1,130	1,130		
Minerals (yearlong)—do	132	113	129	105		
Annual cost of feed per cow—dollars	13.8	10.9	11.0	8.5		
Cow deaths from starvation—number	1	2	0	7	4	6

[1] Includes only the cows remaining in the herds from October 1942 to October 1947. Numbers in this category in herds I to IV, respectively, were: 14,12, 15, and 13. All were native cattle except 6 grade Herefords (2 each in herds I and III, and 1 each in herds II and IV). The first year, October 1942 to 1943, was considered as a period of preliminary treatment and is not included in the averages.

[2] For 8 months previous to this time all cows had received identical treatment. They had been dry for at least 5 months and every cow but one was pregnant.

[3] Herd II was on unburned winter range (supplemented during this period).

[4] Average weaning ages were 226, 231, 235, and 237 days for herds I to IV, respectively.

Seasonal Weight Changes of Cows

The average seasonal trends in cow weights during the last 4 years are illustrated in figure 9. As a rule, herds that lost weight most rapidly during one period gained most during the following period. Therefore, differences in cow weights that developed during the treatment period (October to February or March) tended to disappear by early summer. However, the treatments did have a cumulative effect on cow weights from year to year. Using the weights of July 5 as an index, and making allowances for the calf crop and its effect on cow weights, the approximate increases per cow from 1943 to 1947 were as follows: Herd I, 70 pounds; herd II, 22 pounds; herd III, 13 pounds; herd IV, 6 pounds.

Period of supplemental feeding on range.—After mid-October, cows receiving little or no supplemental feed (herd IV) lost 0.75 to 1 pound of weight per day until they were put into the feed lot February 1 (fig. 9). One pound of protein supplement per head daily maintained the weight of herd III cows through October and November, but they lost considerable weight in December and January. As indicated previously (fig. 5), an

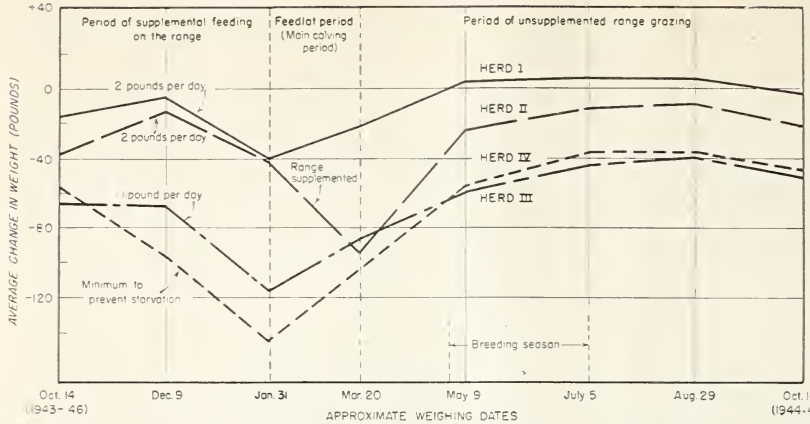


FIGURE 9.—Average seasonal trends of cow weights under the four systems of management during the 4-year period October 1943 to October 1947. Herd II was not placed in a feed lot but on a specially reserved winter range, supplemented with protein meal (2 lb. per head daily). Weight changes are shown in relation to the initial weights on October 14, 1942.

appreciable shift in the cattle diet also occurred during these 2 months, apparently due to lower quality forage. Two pounds of protein supplement enabled the cows of herds I and II (fig. 10) to gain almost as much weight during the first half of the period as they lost during the last half. Differences in net loss for the entire supplemental feeding period on range (table 7) were statistically significant for all herd comparisons except I with II.

Feed-lot period.—During February and early March, which was the main calving period, the cows in feed lot gained considerable weight if they did not calve. Weight losses associated with calving usually were not fully regained during the feed-lot period except in cases where the cows went into feed lot in very poor condition. Average gains or losses (pounds per cow) for the 7-week period were as follows:

	Calved	*Did not calve*
	Weight change (pounds)	*Weight change (pounds)*
Native cows:		
Herd I (dry lot)	−22	47
Herd III (dry lot)	−22	48
Herd IV (dry lot)	13	63
Herd II (range supplemented)	−134	−8
Grade Hereford cows:		
Herd I	−36	123
Herd III	10	144
Herd IV	13	104
Herd II	−83	10

Although the cows of herd II grazing on supplemented range lost heavily during the calving season, they had not lost weight during the preceding period (while receiving the 2-pound rate of supplement), and made greater gains than other herds during

the following period (on unsupplemented range). Although their over-all performance was as good as any other of the experimental herds, the severe losses of weight in cows which calved would indicate the desirability of more adequate supplement than the 2 pounds per day during this crucial grazing period. It is doubtful that herd III cows (supplemented at the 1-pound rate during the preceding period) could have calved successfully if grazed on range during the calving period with the supplement rate applied to herd II, and most cows of herd IV, if grazed at this time on range, would certainly have died without considerable feed during the calving season.

Grade Hereford cows made more gain than native cows in feed lot when they did not calve; otherwise, weight changes of the Herefords and natives during this period were fairly comparable. More detailed comparisons of the grade Herefords are of questionable reliability because of the limited number involved.

Unsupplemented grazing period.—Most of the cow gains on range were made between March 20 and May 9 (fig. 9) when forage quality was highest. Although dry cows continued to gain through August at a moderate rate, cows suckling calves barely maintained their weight in May and June and lost at a steadily increasing rate until the supplemental feeding started in October (fig. 6).

The fall and winter management practices affected the gains in spring, but during the remainder of the season all herds reacted similarly on unsupplemented range. During the period March 20 to May 9, cow weight gains tended to be proportional to fall and winter losses. Gains for this period averaged as follows for cows suckling calves and those without calves:

	With calves	*Without calves*
	Gain (pounds)	*Gain (pounds)*
Herd I	4	44
Herd III	−5	58
Herd IV	25	68
Herd II	48	95

Herd II, which gained most during this period, had lost most weight during the preceding 7 weeks, and herd IV had lost most during the October-January period (fig. 9).

During the remainder of the unsupplemented grazing season, weight differences between dry cows and nursing cows increased, but the herd treatments had little effect on cow gains during the May–October period. Average weight changes per cow between May 9 and October 14 were as follows:

	With calves	*Without calves*
	Loss (pounds)	*Gain (pounds)*
Herd I	56	41
Herd II	40	47
Herd III	47	59
Herd IV	41	48

The grade Hereford cows lost more weight during this period when they were suckling calves, and gained less when dry, than did the native cows ((fig. 6).

F-425262

FIGURE 10.—This experimental herd was fed protein supplement at the rate of 2 pounds per day on range from October 15 to February 1. Photographed in mid-December.

Calving Percentage

There were no significant differences in percentage calf crops (at weaning age) among the four herds nor between native and grade cows. Although stillbirths and mortality of young calves tended to lower the calf crop of herd IV, the difference between the highest and lowest average calf crop shown in table 7 amounts to little more than one calf per herd per year. Such small differences could easily be due to chance. Obviously, the problem of low calf crops from range herds was not solved in this study. Apparently the highest level of nutrition provided during the fall and winter was not adequate to overcome deficiencies of wiregrass range forage either at that or other seasons, especially for cows suckling calves.

Calf Weights

Calf size was definitely influenced by the different management practices applied to the cows during the preceding fall and winter. Herd treatment and breed of dam affected weights at birth as well as at weaning age (about 7½ months) as shown in table 8. In making such comparisons, it was considered appropriate to include all calves whose dams were in the study during the treatment period (October to March) prior to calving. Therefore, table 8 summarizes the calf data for all 5 years and includes 98 more calves than does table 7. Breeds were compared, however, only when calves from native cows and grade cows were present in the same herd.

Birth weights averaged 5 to 7 pounds heavier in herds I and II than in herds III and IV, calves of grade cows showing the

TABLE 8.—*Average birth weights and weaned weights of calves from grade Hereford and native cows under four herd management systems, 1943–47* [1]

Comparisons	Calves compared	Herds				Average of all calves
		I	II	III	IV	
Birth weights [2]	*Number*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Grade	32	65	65	52	51	57
Native	154	51	52	49	46	50
Difference		14	13	3	5	7
All calves (herd avg.)	[3] 202	53	54	49	47	51
Weaned weights [4]						
Grade	32	286	248	239	227	250
Native	154	276	295	281	262	278
Difference		10	−47	−42	−35	−28
All calves (herd avg.)	[3] 202	278	287	274	256	273
Total gains [4]						
Grade	32	221	183	187	176	193
Native	154	225	243	232	216	228
Difference		−4	−60	−45	−40	−35
All calves (herd avg.)	[3] 202	224	233	224	209	222

[1] All calves were sired by purebred Hereford bulls. Breeds were compared only in years when calves of both native and grade dams were present in a herd.

[2] At the 5-percent level, herds I and II differed significantly from herds III and IV; differences associated with breeds of dams were significant in herds I and II only.

[3] 170 of these were from native cows.

[4] At the 5-percent level, weight differences between herds I, II, and III were not significant, but all three were significantly different from herd IV. Differences associated with breed of dams were significant in all except herd I.

greatest difference (13 pounds). Although these differences are not very large, they were consistent and undoubtedly reflect the different levels of nutrition among the herds during the supplemental feeding period.

Weaned weights were quite similar in herds I, II, and III, and roughly 20 to 30 pounds heavier than in herd IV. Here again, calves from grade cows showed the greatest effect of the herd treatments.

The breed comparisons in table 8 may be summarized as follows: At birth the calves from grade cows were larger than those from native cows in herds I and II with their higher supplements, but about the same size in the other two herds. At weaning time, however, the calves from native cows were heaviest in all but herd I, where there was no significant difference between breeds.

In general, the calf data suggest the following conclusions: Grade Herefords, being larger animals than natives, had the largest calves when the nutrition level was high enough to allow them to do so. Under the relatively low levels of nutrition represented in this study, particularly in herds II, III, and IV, native cows produced better gains on their calves. This probably reflects greater milk production by native cows under range conditions. The fall and winter supplemental feeding applied to herd I apparently represents about the minimum level of nutrition at which Hereford cows compare favorably with native cows in calf development. Native cows, on the other hand, produced similar calves under all supplemental feeding practices tested except the poorest (herd IV).

SUMMARY

In the flatwoods forest area of south Georgia and north Florida, where there is little cultivated land, beef cattle are often grazed yearlong on "wiregrass." The nutritive value of this native forage is very low, especially in fall and winter, and range herds without supplements usually lose weight rapidly after mid-October. The most critical period occurs in February and early March, although cows suckling calves also lose weight during the summer.

To investigate possibilities for improving range cattle production and thereby making more effective use of the forest range resource in such areas, the grazing habits and yearlong performance of breeding herds were studied for 5 years. Four fall and winter feeding management procedures were also studied. This report describes the study and presents the results.

Native, or "piney-woods," cows made up the bulk of the breeding herds, but enough good grade Herefords were included to permit limited comparisons between these two lines of breeding. All cows were bred to purebred Hereford bulls. One-third to one-half of each range was prescribed-burned in winter and the cattle were held off the burned range during February and early March while sufficient new growth was developing to support the herds. During this period they were maintained in feed lot or on separate unburned range.

From March to September the cows spent a high proportion of their grazing time on current prescribed winter burns even though these areas were closely grazed and forage was limited. Cattle gains were influenced by the amount of burn available during this period. Also, the heavy grazing of burned range damaged the productivity of the bunchgrass species. After September, the forage on current burns had lost its advantage in palatability and the cattle were more willing to graze unburned areas where forage was more abundant. It appears that grazing capacity during the spring and summer should be based entirely on the burned acreage; at least 6 acres per cow seemed to be needed for this period under the conditions studied.

Close observation of the grazing animals revealed that their range diet in the spring consisted mainly of two grasses, pineland

threeawn and Curtiss dropseed. Bluestem grasses, Curtiss dropseed, carpetgrass, Florida dropseed, and toothachegrass were important during the summer and fall. Curtiss dropseed was the principal species utilized during the winter.

Chemical analyses indicated that the range forage was deficient in protein and minerals most of the year. Only in March did the protein content satisfy the estimated requirements for growing animals or lactating cows. Special measures were required to induce the cows to eat enough mineral supplement to keep blood phosphorus above the critical level after midsummer when they were suckling calves.

At breeding time, cows suckling calves had regained only a small proportion of the weight losses of winter or those associated with calving, and were generally losing or barely maintaining their weight during the breeding period. Most of these cows failed to calve the following year. Dry cows, on the other hand, gained weight during the feed-lot period and before and during the breeding season, and usually bred successfully. The average calf crop of cows that produced calves the previous season was only 16 percent. In comparison, the average calf crop of cows that were dry the previous year was 91 percent. The average calf crop for the 54 cows that remained in the study for the full 5-year period was 58 percent. The low quality of range forage appears to be the underlying cause of the low calving percentage of cows suckling calves. The low maintenance condition of cows suckling calves is also reflected in small calves at weaning time. Where cows calved 2 years in succession, the calves in the second year weighed 26 pounds less than calves from the same cows the preceding year.

Four procedures of fall and winter management, involving supplemental feeding of protein meal at three levels from mid-October through January, and feed-lot maintenance (on a ration of 20 to 25 pounds of chopped sugarcane and 2 pounds protein meal) vs. supplemented unburned range from February 1 to March 20, were compared in separate breeding herds. Herds I, III, and IV were maintained on dry lot for the February 1 to March 15 period each year; herd II was on range yearlong. Herds I and II received 2 pounds and herd III 1 pound of supplemental feed per head per day for the October 15 to January 31 period, whereas herd IV was given only enough supplemental feed to prevent starvation.

The fall and winter feeding procedures affected weights and death losses of cows, and birth weights and weaning weights of calves, but did not influence the percentage calf crop sufficiently to be statistically significant.

Marked differences in cow gains (or losses) during fall and winter were directly related to the level of feeding, but differences tended to disappear the following spring when the thinnest cows gained most weight. There was, however, a cumulative effect in favor of the higher levels of feeding.

Herds I, II, and III, apparently represented about the minimum acceptable level of supplemental feeding for wiregrass range. Among these herds the native cows produced comparable calves

with average weaning weights of 276 to 295 pounds. Calves from Hereford cows were smaller at weaning time than those of native cows, except in herd I with its higher nutrition level, where they were similar.

The level of feeding applied to herd IV was unsatisfactory. This herd received no range supplement in 3 out of the 5 years. In 2 years, however, 1 to 2 pounds per head per day were required during the last 6 weeks of the grazing period to prevent an estimated 80 percent death loss. Calves were smallest in this herd and death losses from starvation averaged 7 percent per year. Death losses were proportionately greater for Hereford cows than for natives. The calf crop also tended to be smaller in this herd because of stillbirths and mortality of young calves.

Results from the native cows in herds I, II, and III provide an illustration of what might be expected from such low-cost management of range cattle. With a 50-percent calf crop during the years 1944 to 1947, following a high calf crop in 1943, average annual production was approximately 140 pounds of calf per cow. The yearly feed investment per cow for the four-year period was 210 to 320 pounds of cottonseed or peanut meal, 130 pounds of minerals (including salt), and 1,100 pounds of chopped sugarcane (or 3 to 4 acres of additional winter range). At prices prevailing during the study, average feed costs ranged from 7½ to 10 cents per pound of calf produced. Additional costs, not evaluated in this study, would include fencing, death losses (1 or 2 percent), interest, and miscellaneous management expenses including the cost of burning if this were done primarily to improve the forage.

Increasing the percentage calf crop offers most promise for improving the productivity of range herds. A higher level of year-long nutrition than was provided in this experiment will be required to induce a high percentage of cows suckling calves to breed, and hence to obtain a high sustained calving percentage. In addition to providing a larger amount of range forage for each animal—especially winter-burned range in adequate amounts for spring and summer grazing—the native forage will apparently need to be supplemented with other forage or feed much of the year if a high level of herd productivity is to be obtained.

COMMON AND BOTANICAL NAMES OF RANGE PLANTS MENTIONED

Grasses and Grasslike Plants

Bluestems	*Andropogon* spp.
Carpetgrass	*Axonopus affinis*
Coastal lovegrass	*Eragrostis refracta*
Curtiss dropseed	*Sporobolus curtissi*
Florida dropseed	*S. floridanus*
Lopside Indiangrass	*Sorghastrum secundum*
Panic grasses	*Panicum* spp.
Pineland threeawn	*Aristida stricta*

Grasses—Continued

Sedges	*Carex* spp.
Toothachegrass	*Ctenium aromaticum*

Forbs

Aster	*Aster walteri*
Goldaster	*Chrysopsis graminifolia*
Pipewort	*Eriocaulon* spp.
Tickclover	*Meibomia* spp.
Trilisa	*Trilisa odoratissima* and *T. paniculata*

Shrubs

Blackberry	*Rubus cuneifolius*
Gallberry	*Ilex glabra*
Lyonia	*Lyonia fruticosa* and *L. mariana*
Myrtle dahoon	*Ilex cassine myrtifolia*
Sawpalmetto	*Serenoa repens*
Swamp cyrilla	*Cyrilla racemiflora*

☆U. S. GOVERNMENT PRINTING OFFICE: 1953—256196

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price 15 cents